UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Summary Review of Monthly Reports*
for
SOIL CONSERVATION SERVICE RESEARCH**

APRIL 1946

EROSION CONTROL PRACTICES DIVISION

Soil Temperature Varies with Type of Tillage - C. L. Englehorn, Fargo, North Dakota.-"At seeding time at Langdon, North Dakota the temperature of the surface soil varied with the type of tillage. Soil temperatures were taken during the afternoon of April 19 by means of an ordinary glass laboratory type of thermometer. During this time atmospheric temperature remained fairly constant at 50 degrees Fahrenheit. In the data below, each figure is the average of six readings."

Soil temperatures in degrees Fahrenheit at 1, 2 and 4 inch depths with five methods of tillage of wheat stubble land for seeding to spring wheat.

Tillage Method	Soil temperature, degrees F, at depths of		
	1 inch	2 inches	4 inches
Spring plow	54.9	49.8	46.4
Fall plow	57.9	50.9	47.5
Fall oneway	54.7	49.3	47.1
Fall Field Cultivator	53.8	48.7	45.7
Fall stubble mulch	48.6	46.6	44.1

No Wind Erosion on Subsurface-Tilled Plots - Torlief S. Aasheim, Bozeman, Montana.-"At Culbertson, Montana, none of the sub-surface tilled plots with residues on the surface showed any signs of wind erosion. Subsurface tilled plots which were burned before summer fallow operations were started lost considerable soil due to wind erosion. Several of the plots which had been mold board plowed also drifted considerably. Of the mold board plowed fallow only the basin listed plots were entirely free from soil movement due to wind.

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**All Research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

"No trouble was experienced in seeding the sub-surface tilled fallow plots at Culbertson this year. A treader was used behind the sub-surface tillers during the fallow season and this helped to break up the straw and anchor it in the soil. This spring it was difficult to differentiate between fallow tilled with a oneway and fallow tilled with sub-surface tillers. Fallow tilled with a one-way last summer looked very good this spring, and none of the plots showed evidence of wind erosion."

Sage Eradication by Sheep - Bruno Klinger, Fort Collins, Colorado.- "While examining sand sage areas for eradication trial sites, we found several pastures entirely clear of sage, though surrounded by heavily-infested areas. Inquiry among ranchers brought out information that grazing by sheep had accomplished the apparent miracle. One pasture was cleaned up in the early '30's, another in the period 1937-1940. No specific information is available about condition of the grass cover by the time the sage had been sheeped out, but at present the grass composition is much the same as on other sandsage areas. It would be quite informative, if one could study the stages of sage eradication by sheep, recording the condition of the grass cover meanwhile."

Moisture Conditions at Somis, California - Maurice Donnelly, Riverside California.-"Total rainfall of 9.48 inches from September 1945 to April 1946 was considerably below the average of approximately 14 inches. Almost one-half of the total came in the single storm of December 20-24, 1945, when 4.50 inches fell. One of the notable features of this 1945-46 rainfall season was the extreme dryness of January and February. The monthly distribution was as follows:

1945				1946			
September	October	November	December	January	February	March	April
Inches of Rainfall							
0.04	0.70	0.28	4.67	0.26	1.07	2.34	0.12

"Runoff was almost totally confined to the storm of December 20-24, 1945. On shallow claypan soils at Somis seeded to grain in the fall of 1945, runoff is estimated to range from 1.0 inches to 1.5 inches. From deeper claypan soils seeded to grain the runoff is estimated to range from 0.5 to 1.0 inches. From claypan soils farmed continuously to lima beans and contour ripped in the fall of 1945, runoff was the same order of magnitude as that from seeded grain fields in similar soil, ranging from 1.0 inch to 1.5 inches. Contour ripping is a fall tillage operation in which a chisel is dragged through the soil to a depth of 7 to 9 inches along a contour line. From claypan soils in clean fallow and contour subsoiled in the fall of 1945, runoff was practically zero. Contour subsoiling is performed much like contour ripping except that the depth of operation is from 12 to 16 inches. A coarse cloddy condition is produced over nearly all the surface by such contour subsoiling, whereas in contour ripping much of the surface is left covered by the fine soil mulch prepared previously for lima-bean seedbed. Runoff was likewise practically zero at Somis from primary non-claypan soil in clean fallow and contour subsoiled. Where such soils were in clean fallow and not subsoiled, minor runoff took place.

"From claypan soils farmed continuously to lima beans and contour ripped in the fall of 1945, washoff in the December 1945 storm is estimated at 25 tons per acre. Washoff from seeded grain fields ranged from 5 tons per acre on the deeper claypan soils to 25 tons per acre on the shallow claypan soils.

"The depth of moisture penetration was from 18 to 30 inches. In the case of the shallower penetration, downward movement was impeded by tight subsoil. Water data on three typical profiles are given herewith. Moisture is stated as per cent of dry soil. The soils were under identical treatments which includes deep contour, subsoiling, and clean winter fallow.

	Soil Depth Sampled--Inches								
	0-6	6-12	12-18	18-24	24-30	30-36	36-48	48-60	60-72
	Moisture Percentage								
Primary non-claypan soil	21.4	20.8	21.2	22.7	20.2	18.9	17.5	18.0	17.1
Secondary claypan soil deep A horizon	21.0	20.5	19.5	18.5	14.7	14.2	12.4	10.7	-
Secondary claypan soil shallow A horizon	20.2	20.9	16.4	11.1	10.6	12.5	-	-	-

"In a soil where downward movement of rainwater was not impeded by a tight subsoil, about one-half of the total rainfall, or from 4.0 to 4.5 inches, expressed as surface inches of water was stored for use by a summer-growing crop. The remainder was lost by evaporation. Dry-farm covercrops made little or no growth in the early and mid-part of the season. On the fields where these data were taken there was almost no moisture lost by transpiration."

Soil Moisture Under Alfalfa and Brome by Age of Stand - G. M. Browning, Ames, Iowa.-"Soil samples were taken for moisture determination at one foot intervals up to eight foot under stands of brome and alfalfa that had been down for different numbers of years. These samples were taken on Ida, Monona and Marshall soils in Monona and Woodbury counties. Results are shown in the accompanying table.

"It is planned to determine the field capacity and wilting coefficient on certain of these profiles in order that the amount of water available to plants can be calculated for these profiles. On the basis of information obtained from other profiles in that area, the field capacity on Monona and Ida soils is approximately 20-22 percent and the wilting coefficient from 10-12 percent. Assuming that the samples will be similar to the ones on which information is available, it is evident that there is little or no available water for plants below the three foot layer on fields that have been down to alfalfa for three or more years.

Soil Moisture under Alfalfa and Bromegrass, in western Iowa, by age of stand

Crop and field number	Age of stand	Depth of Samples (feet)							
		1	2	3	4	5	6	7	8
	Years	Percent Moisture							
Alfalfa									
1	1	20.1	19.9	19.5	16.5	15.8	15.5	16.7	15.9
2	2	20.1	20.0	20.0	19.0	16.2	15.3	16.4	16.0
3	3	18.8	16.9	16.2	14.1	13.6	13.2	12.2	11.5
4	3	17.9	18.4	19.4	18.6	13.8	12.6	13.0	12.4
5	4	20.5	18.9	17.0	12.9	10.4	10.4	9.9	10.4
6	5	19.2	17.4	12.5	10.9	10.2	9.4	9.5	9.6
7	5	17.6	13.9	11.6	12.2	13.0	12.0	12.1	11.1
8	5*	22.2	13.5	10.0	10.8	10.5	10.1	10.4	10.0
9	6	20.6	20.8	14.2	12.1	10.8	9.8	10.4	9.6
10	6	17.5	17.9	17.5	14.1	10.2	10.1	11.1	11.5
Alf-Brome									
1	2	27.6	25.1	23.4	19.0	18.4	18.4	18.8	20.4
2	7	22.4	19.8	18.2	13.5	12.4	11.7	11.7	10.9
Brome									
1	5	19.7	17.0	12.3	12.5	12.3	13.4	14.2	12.1
2	5	20.8	18.3	17.1	15.9	14.5	14.9	15.0	15.9

* This field was also in alfalfa 1928-37, corn 1938, corn 1939 and oats seeded to alfalfa 1940. All figures are the average of duplicate samples from each field for each depth.

"Attention is called particularly to the alfalfa field number 8 which was in alfalfa for several years prior to reseeding in 1940. In this profile, the second foot depth is only slightly above the wilting coefficient and all lower depths are the same or below the wilting coefficient. It is evident that in this profile there is little moisture available for plant growth and the farmers are very definitely concerned as to what will happen to crops when this field is plowed. Unless adequate rainfall is obtained during the summer months it is evident that there will be a crop failure.

"With the need for large increases in the acreage of forage crops on the steep Ida soils to control erosion, it is evident that additional information is needed to determine the number of years that alfalfa and brome or a mixture of brome and alfalfa may be left down without seriously depleting the supply of subsoil moisture and causing serious damage in the succeeding crops."

Alfalfa-Bromegrass Observations - Dwight D. Smith, Columbia, Missouri. "April observations of the alfalfa-bromegrass field test plots established in the spring of 1945 indicate that the stand and growth on the plowed plots were superior to that on the disked plots in most cases. Manure with phosphate fertilizer produced better stands and growth than 4-12-8 fertilizer for most of the comparisons. The early spring growth on the plot with surface application of fertilizer appeared slightly superior to that with the plow-sole application. The stands of alfalfa have been medium to very poor and of brome good to poor. The stand of brome was more uniform than that of alfalfa although

its appearance indicated a lack of nitrogen, especially where the alfalfa was thin. Four of the tests were established on soils depleted of organic matter and with medium to severe erosion."

Microbes and Residues - F. L. Duley, Lincoln, Nebraska.-"In our microbiological work, counts have been made to get additional information on the effect of residues on numbers of fungi and total count (bacteria plus actinomyces). The results indicate that the count goes up wherever the organic matter is undergoing decay. On subtilled land the greatest numbers of organisms is in the surface inch. Where the residue has been turned under the higher count is in the 1-6" layer. A sample of the results is shown below":

Microbial Populations from Rotation Plots March 28, 1946

Depth	No residues plowed	Residues plowed	Residues subtilled	Mean
		Fungi $X10^4$		
0-1"	29.1	31.7	58.3	39.70
1-6"	55.7	52.4	43.2	50.43
Mean	42.4	42.05	50.75	45.07
		Total count $X10^6$		
0-1"	25.9	32.3	57.2	38.47
1-6"	43.0	52.0	55.8	50.27
Mean	34.45	42.15	56.5	44.37

Cropping Practices Affect Earthworm Populations - Henry Hopp, Beltsville, Maryland.-"Following the finding we reported last month that earthworms may be an heretofore overlooked factor in decreasing the erodibility of soil, we made a survey of earthworm populations on the rotation plots of the University of Maryland. Water-stable soil aggregation was also determined. The results for various annual cropping systems are shown in the accompanying table.

The most important fact revealed by this study is that earthworm populations as high as in permanent sod can be maintained on cropped land by proper management methods. Winter grain-summer legume cropping appeared to be a high-yielding system that is especially favorable for earthworms and soil aggregation."

Cropping Plan	Earthworms per acre		Soil aggregation (Percent)
	Number (Thousands)	Weight (Pounds)	
Corn, annually	51	59	25
Corn, in 2-year rotation	87	52	44
Corn, in 3-year rotation	197	120	48
Drilled soybeans for hay, annually	98	70	31
Drilled soybeans for grain, annually; haulm turned in followed by a winter cover crop	151	148	30
Drilled soybeans for grain, annually; haulm left on surface, no winter cover crop	332	337	34
Winter grain, annually, idle during summer	238	135	48
Winter grain, annually, legume during summer	394	258	60
Permanent legume sod	342	306	69
Permanent grass sod	423	226	70

Warm Dry April Hastens Wheat Maturity - Alvin E. Lowe, Garden City, Kansas.-"April was a warm dry month, in spite of freezing temperatures occurring four times during the month. Precipitation in April totaled .84 in. with .50 being the most in any one rain. This is 1.11 inches below the 38 year average of 1.95 inches for April.

"The dry, warm weather caused the continuous crop wheat to use up its soil moisture. Most of the continuous crop wheat is 8 or 10 inches high and turning brown with the main stalk trying to head. The fallow wheat looks much better, but has not grown much in height during the month. Some of it has exhausted the soil moisture and is starting to burn, especially those fields or plots needed at a heavy rate or on an early date or on poorly prepared summer fallow. Most of the fallow wheat looks good and will make an average crop of 10 to 15 bushels per acre."

Soil Capabilities of Wet Soils After Drainage - Richard M. Smith, Morgantown, West Virginia.-"At the request of the Greenbrier Valley District Supervisors and of the Soil Conservation Service field technicians, a field study of the wet soils of the Meadow River Valley was made in cooperation with the State Survey Supervisor, to determine the capabilities of these soils for intensive use if the entire area was drained by a major downstream engineering project. We also collected some typical soil samples for laboratory study to supplement the laboratory data previously obtained.

"Our report has now been prepared. The soils of the area were grouped into classes corresponding with the standards set up in Mimeo Cir. 54, released by the Experiment Station last year, and the discussion and recommendations were worked out in essential agreement with this circular. The estimated acreage of crops that could be grown each year in the Meadow River bottom

after elimination of the most serious flood hazards and obtaining other reasonable degrees of drainage is as follows:

Grass and clover, hay & pasture	3400 acres
Corn (or potatoes)	850 "
Soybeans	900 "
Small grains	850 "

"The large acreage of hay and pasture appears necessary because of the predominance of light colored, strongly acid, clay soils which would certainly be very difficult to manage as regular crop land.

"Organic Matter in Pasture Tillage Trials - A few soil samples collected from three year old pasture tillage field trial areas show some interesting organic matter relationships:

Location	Sample Depth	Kind of Tillage			
		None	Disk	Plow	Spring Tooth
	Inches	Percent Organic Matter			
Nicholas Co. No.1	0-3	7.10	6.79	4.54	-
Greenbrier Co. No. 1	0-1½	-	5.70	2.87	-
	1½-3	-	3.20	2.38	-
Nicholas Co. No. 2	0-1½	5.14	-	3.13	5.12
	1½-3	2.92	-	2.50	3.33

"These data illustrate a point which we believe is of major importance in explaining the success of some legume seedings on shallow tilled seedbed compared to plowed seedbeds. The soil organic matter content at the surface on the shallow-tilled seedbed is almost twice that on the plowed seedbed. This is probably more significant than the surface trash in its influence on new seedings in many cases.

"Another point of interest is the apparent increase in organic matter at the surface on plowed seedbeds during the three years since seeding. Following thorough disking of the plowed seedbeds we expect a rather uniform layer at the surface to a depth of three inches or more. But in the comparisons shown the surface layer now has a significantly higher content of organic matter. The magnitude of this apparent increase during three years is of the same order of magnitude as the organic matter buildup obtained in the studies of eroded soil reclamation."

Dollars and Cents Value of Contour Farming - E. L. Sauer, Urbana, Illinois.-"Using the 7-year average yield increases for contouring shown below and applying 1945 average Illinois farm prices, the dollars and cents gains per acre from contour farming sloping Illinois cropland in 1945 can be approximated. Contoured fields include fields contour-tilled with terraces, buffer strips, and strip cropping. Crop fields not on the contour were planted up and down the slope or following the usual field pattern.

Crop	Ave. Yield Increase 1939-45	1945 Ill. Farm Price	Increased Returns Per Acre from Contouring
Corn	6.9 bu.	$1.07	$7.38
Soybeans	2.7 bu.	2.09	5.64
Oats	6.9 bu.	.68	4.69
Wheat	3.4 bu.	1.58	5.37

"Increased yields from contouring in 1945 were slightly lower than the seven-year average for corn and slightly higher for soybeans, oats, and wheat. Contour farming resulted in substantial yeield increases in each of the Illinois areas studied."

Effect of Phosphate on Hay Yield - H. O. Hill, Temple, Texas.-" A number of the winter legumes were sampled to determine the response to phosphate. The following tabulation shows the response or lack of response to 400 pounds of superphosphate per acre.

Date	Legume	No Phosphate	With Phosphate	Difference
		Lbs./A	Lbs./A	Lbs./A
4/29/46	Lappacea clover	2801	2394	-407
4/29/46	Hairy vetch	1424	1179	-245
4/29/46	Williamette vetch	895	801	-94
4/29/46	Ladino clover	1222	1623	401
4/29/46	Alfalfa	1445	2048	603
4/29/46	Bien. White Sw. Clover	1204	2172	968
4/29/46	Madrid clover	1468	2505	1037
3/11/46	Austrian winter peas	2194	3401	1207
4/29/46	Emerald	1675	3128	1455
4/29/46	Hubam*	3583	5879	2296

* Stemmy.

"In turning under barley green manure in 1945 on some test areas 400 lbs. of superphosphate per acre was applied. The residual effect of this phosphate was evident on hubam in oats grown on this area in the spring of 1946. On the phosphated plots the hubam clover is considerably taller than on the surrounding area."

Thick Stand of Kudzu Crowns in Corn Rotation - E. C. Richardson, Auburn, Alabama.-"In 1941, kudzu was planted along bench terraces and midway between each two benches. In 1943 and 1944, it was plowed for corn, leaving kudzu on the benches to grow out over the intervals to provide cover, and to re-establish kudzu in the rotation system. A portion of the corn was fertilized with nitrate of soda at the rate of 225 pounds per acre.

"In late March, 1946, a crown study was made for the purpose of determining the total number of crowns and the size of the crowns that developed in the terrace intervals after the last cultivation of corn. Counts made in areas of 100 square feet indicated over 20,000 crowns per acre of which 30 to 40 percent were more than one-fourth inch in diameter. The averages for three terrace intervals are as follows:

Kudzu Crowns Per Acre Developed After the Last Cultivation of Corn, Kudzu-Corn Rotation 1944 and 1945

Year	With Nitrate	Without Nitrate
	Kudzu Crowns Per Acre	
1944	28,900	32,900
1945	22,300	29,600

"In general, fewer crowns were developed in those areas where nitrate of soda was applied to the corn. Nitrate increased the growth of grass, which apparently reduced the formation of crowns. Fewer crowns and a smaller proportion of quarter-inch crowns were produced in the 1946 count than in 1945. Cultivation in 1944 and 1945 destroyed most of the old crowns; therefore, crowns formed in 1945 and counted in 1946 were from runners which originated from the benches."

Cecil Soils Need Minerals - B. H. Hendrickson, Watkinsville, Georgia.- "Quick-test soil analyses made at the Station during April indicated rather low levels of phosphorus and potash in the soil due to grazing off of grasses and clovers in the permanent pasture; in sericea and lespedeza fields where hay is harvested; and in grain sorghum fields. This confirms the generally accepted idea that mineral additions in fertilizers should vary according to crop demands, since there is not much of a "back-log" of inherent fertility in Cecil soils."

Processing Oriental Chestnuts - Joseph C. Moore, Auburn, Alabama.- "Oriental Chestnuts processed in a pressure cooker for 10 minutes are keeping in a fine way after 8 months. Fresh nuts were hulled, ground in a food chopper, placed in pint glass jars, and processed in a pressure cooker 10 minutes at 15 pounds pressure during September 1946. These ground nuts are excellent filler for meat dressings.

"A profitable soil erosion scheme has been worked out using Oriental chestnuts as an overstory on poor eroded soil with lespedeza sericea as a ground cover. The sericea is mowed for hay. Several of the chestnut trees have born 25 pounds of nuts per tree at 7 years of age."

Rye and Vetch Survive Subsurface Tillage - T. L. Copley, Raleigh, North Carolina.-"The green, rank growth of rye and vetch winter cover, used in the continuous corn mulch plots was not entirely killed, even with two subsurfacings in preparation for corn. Both March and April were rainy, and under such conditions these winter covers do not appear very satisfactory for mulch farming."

Winter Cover Crop Observations - John T. Bregger, Clemson, South Carolina.-"Careful observations were made of winter cover crop plots in the experimental orchard. The following items are worthy of reporting:

(1) Rye following rye (several years) showed very sparse and poor growth.

(2) Rye in combination with Korean lespedeza, with same fertilization program, showed rank growth and excellent cover.
(3) Hairy vetch after several years of succession still produced a complete stand and heavy cover.
(4) Vicia grandiflora produced excellent cover, even better than hairy vetch.
(5) Chilean tares (V.sp.) made a relatively inferior stand last fall following natural reseeding, but a good growth of plants this spring.
(6) LeConte vetch after reseeding for two years spread over considerable area and gave a very thick stand. This species of vetch matures seed very early and is the most promising new cover crop we have tried out.
(7) Southern spotted bur clover with natural reseeding gave excellent stand and heavy cover.
(8) Button clover with natural reseeding produced a heavy thick stand; one of the best.
(9) Crimson clover with natural reseeding made excellent stand after five years on same ground with no additional seed added. When this clover is not cultivated it reseeds successfully year after year.
(10) Singletary pea with natural reseeding made excellent stand following a very disappointing stand last year. Evidently it takes more than one year for this species to get a good start. It will be observed another year before any definite conclusion is reached.
(11) Tangier pea. Very heavy stand, probably heaviest of all winter cover crops in terms of tonnage. Seed very scarce and high but apparently with natural reseeding this species may be used where cultivation during early summer is not essential.
(12) Several crotalaria species gave good over-winter residues and is our most promising summer legumes for orchard use in terms of winter residue which will not completely decay until mid-summer.
(13) Soybean-Sudan grass combination gave a fair residue. The soybean portion of the mixture does not show up much, but with the Sudan grass supplying most of the residue this mixture remains one of the most promising for orchard use. In general, however, summer cover crops have not proved satisfactory in terms of increased yields."

Aggregation of Soil Particles in Potato Rotations - Sterling J. Richards, New Brunswick, New Jersey.-"Micro-aggregation determinations were made on samples from the potato rotation plots at Marlboro. The samples were taken on November 13, 1945. The average percentage aggregation of silt and clay for three plots for each rotation was as follows:

Rotation 1/	Percent Aggregation of Silt and Clay
Continuous Potatoes	65.3
Potatoes, barley and soybeans	62.7
Barley and soybeans, potatoes	65.7
Potatoes, sod	67.7
Sod, potatoes	69.3
Wheat and sod, potatoes	67.7
Potatoes, wheat and sod	70.3
Wheat and sod, sod, potatoes	65.3
Potatoes, wheat and sod, sod	66.7
Sod, potatoes, wheat and sod	70.3

1/ The last named crop in each rotation is the one grown in 1945."

Grant County Report Available - H. O. Anderson, LaCrosse, Wisconsin.- "The report "Six Years of Soil Conservation Farming in Grant County, Wisconsin" was mimeographed for use of Soil Conservation Service and Extension Service personnel. This report was also submitted to the Bulletin Reading Committee of the Wisconsin Agricultural Experiment Station for approval as an Agricultural Station bulletin."

Excessive Soil Losses from Corn and Winter Wheat - C. A. Van Doren, Dixon Springs, Illinois.-"Only eight crops of corn, when produced in a three year rotation of corn, winter wheat, and lespedeza, would remove an additional inch of soil on a 9 percent slope with a slope length of 210 feet. Soil losses during the five month periods when three crops of corn were produced have varied from four tons per acre on 5 percent slopes 35 feet in length to 17.8 tons on 9 percent slopes 210 feet in length. General soil losses have been greater from winter wheat on 5 percent slopes than from corn. Losses from winter wheat varied from 6-1/2 tons to over 15 tons per acre during the 7 month period when winter wheat was produced in the rotation. Extent of the losses depended upon steepness of slope and plot lengths. Excessive soil losses obtained from winter wheat are explainable by the fact that soil moisture is not always replenished early enough in the fall to permit early seeding and vigorous growth before winter and spring rains occur.

"In problem areas where the surface soil, through past erosion, has been reduced to three or four inches, the soil losses which have been secured cannot be tolerated if the land is to remain in agricultural production.

"Although losses from lespedeza have been higher than from well established grassland on similar slopes, the losses in general have been considerably less than from corn or winter wheat.

"The following soil losses, in tons per acre, were secured from duplicate plots on 5 and 9 percent slopes, with a plot length of 70 feet:"

Crop	Slope 5%	9%
Corn	5.6	13.5
Winter Wheat	11.2	10.6
Lespedeza	5.8	6.1
Average per year	7.5	10.1

Irrigation, Drainage, and Fertilizer Field Trials - John Lamb, Jr., Ithaca, New York.-"The planning of irrigation field trials is underway in Chautauqua, Erie, Ontario, Allegany, Tompkins, and contemplated for Genesee Counties. Drainage trials are planned for Erie and Chautauqua. Cover-crop trials are underway in Wyoming. Two field trials in Cayuga County were planned with Messrs. Walker and Messer.

"A field trial cover-crop experiment with fertilizers has been set up in a vineyard about 3 miles north of the Hammondsport experimental vineyard. The vineyard consists of about 3-1/2 acres of three-year old Delawares. The present cover is domestic rye grass. Six treatments with 8 replications were set up, making 48 plots in all. The owners will furnish all the labor necessary.

"The fertilizer treatments are as follows:

Treatment	N	P_2O_5	K_2O
1	0	0	0
2	16	0	0
3	32	0	0
4	32	0	32
5	32	32	0
6	32	32	32

As the vines increase in size, these amounts will be increased."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio.-"The month of April 1946 was noted for its total lack of runoff water from the upland watersheds. Only 1.50 inches of rain fell. This is about one-half normal. Rain fell on 13 days, the maximum amount in any one day being 0.54 inch. The maximum 5-minute rainfall intensity amounted to 0.4 inch per hour. It is clear why no surface runoff occurred.

"Stream flow from a 300-acre watershed came from ground-water storage entirely. The fact that minimum flow was less this month than at any other similar period for the past 8 years, is evidence of unusually low ground-water levels for this season. The lowest daily flow for April 1946 (0.005 inch) is about one-third less than previous low flow for past Aprils.

"There were 11.97 inches of water in the 40-inch profile at watershed 109 on April 2, and 10.48 inches on April 26. As precipitation was much below normal during the month these watersheds are much drier than usual at this time of year but the dry conditions are largely confined to the top soil and upper subsoil. Moisture conditions in the lower 20 inches of the 40-inch profile are not much different from other years.

"Excellent progress in plowing and disking land for corn was made. Dry surface soil near the end of the month made plowing difficult. Two strips on the 75-acre, improved-practice watershed were prepared for corn by: (1) Plowing (standard practice), (2) plowing with mold boards removed, and (3) disking (20-inch heavy disk). With good weather, the latter two methods should provide satisfactory seed beds and good surface mulch protection."

Hydrologic Studies - J. A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebraska.-"For April precipitation at the meteorological station was 0.27 inch, which is the lowest April recorded on the project. This is 2.3 inches below the average rainfall at Hastings, Neb., based on the 46-year average. The wheat is beginning to turn brown in spots and unless moisture is received soon, the yields in this section will be small."

Hydrologic Studies - R. B. Hickok, Lafayette, Indiana.-"It was the driest April for Lafayette since 1916, and only four drier have occurred since the beginning of record in 1869. An average of only 1.66 inches was recorded at the Throckmorton Farm, and 1.31 inches at the Dairy Farm, or 53 percent and 42 percent, respectively, of the April 'normal' for the locality. Only very light showers occurred during the month up to the 28th, when approximately 0.80 inch of rain fell at the Throckmorton and 0.60 inch at the Dairy Farm. There was no runoff from any of the watersheds.

"Chemical analyses were started on the 1945 crops from the experimental watersheds to determine effects of conservation treatment on their nutrient values. The following table shows comparison of protein contents of corn and hay crops:

Table 1.--Protein analyses of corn and hay from conservation and 'prevailing practice' treated watersheds

Purdue-Throckmorton Farm, Lafayette, Ind., 1945

Crop	Treatment 1/	Watershed No.	Percent prob.
Corn	Prevailing	10	7.6
		15	7.4
		Average	7.5
"	Conservation	14	8.2
		18	8.2
		Average	8.2
Hay	Prevailing	5	11.2
		8	11.3
		Average	11.2
	Conservation	6	11.8
		7	13.3
		Average	12.0

1/ Corn, wheat, meadow rotation, 'square' tillage and seeding, common (light) fertilization on 'prevailing' practice watersheds; same rotation contour seeding, heavy fertilization and manure plowed under for corn, heavy fertilization, and manure top dressing of wheat on conservation-treated watersheds; 1st year of 2nd rotation under differential treatment."

Hydrologic Studies - R. G. White, East Lansing, Michigan.-"In checking runoff calculations for the month of March, certain errors were found, making the runoff table included in the March report incorrect. The following table gives the correct figures:

Date	Cultivated Watersheds			Wooded Watersheds	
	Precipitation	Runoff			
		"A"	"B"	Precipitation	Runoff
	Inches	Inches	Inches	Inches	Inches
Mar. 1-3	0.06	1.0691	1.1701	0.03	0
Mar. 3-6	1.23	.9164	1.1457	.93	.0726
Total for Month	2.16	1.9855	2.3158	2.19	.0726
Percent Runoff		91.92	107.21		.03

Hydrologic Studies - John Lamb, Jr., Ithaca, New York.-"April showers were decidedly lacking this year, the monthly total being only 1.79 inches; 1.24 inches below the station 10-year average. Temperatures were below normal, the average mean being 3 degrees below that for the past 3 years. A snowfall of 5 inches occurred on the 26th and 27th which soon disappeared with subsequent rising temperatures and resulting peak flow for the month.

"Due to the small amount of precipitation during January through March, the soil was very receptive with resulting low runoff. All rain gages and runoff recording equipment were put in running order for the summer period.

April data

	Idle land in weeds	Woodland
	Degrees	Degrees
Maximum temperature	81	85
Minimum temperature	21	21
Average maximum temperature	52	54
Average minimum temperature	31	30
Average mean temperature	42	42
Precipitation, inches	1.79	1.79
Runoff, inches	.4418	.0171
Runoff in percent of precipitation	.25	.01
Peak flow, inches per hour	.0011	.0009

Hydrologic Studies - D. A. Parsons, Auburn, Alabama.-"In an intensive study of the storage and movement of the water of a watershed in this region, it is necessary to have a measure of the specific yield of the water-bearing material. The specific yield may be defined as the proportion of a given space below the water table, or ground-water level, that is occupied by drainable water. There are several reasons why it is difficult to determine its true value; nevertheless, an attempt has been made for the watershed of one of our experimental ponds.

"For each of several sizable rains occurring in late winter and early spring, when the evapo-transpiration and soil moisture deficiencies were low, the mean depth to the water table was recorded for each day, beginning on the first day of rainfall and ending several days thereafter when the rate of fall of the water table became normal. The normal daily rates of fall, corresponding to each recorded position of the water table in the period, were tabulated and summed. To this sum was added the increase in ground water elevation from the beginning to the end of the period. This gave the effective rise in the water table due to the penetration of rainwater.

"The amount of water reaching the water table was the rainfall, minus the surface runoff, and minus the soil moisture deficiency. The soil moisture deficiency was calculated by using an assumed value for evapo-transpiration (1/2 to 9/10 of floating pan evaporation) for a period, beginning with the day following the last previous day of ground water accretion and ending with the last day of the rain under consideration.

"The mean effective rise in the water table for each inch of rainfall that penetrated to ground water was 26.7 inches. This gives a specific yield of .0375. Having this figure and using a reverse process, ground water additions and soil moisture deficiencies can be estimated during the warm part of the year. The average depth to the water table was about five feet for this determination. Additional data and study may indicate that specific yield varies with average depth to ground water.

"The lake is stocked with blue-gill bream, large-mouth bass, crappie, and catfish. The bream and bass provide most of the fishing. The weight of bream caught is normally greater than that of all others put together. For this reason, and for the reason that all aquatic life in the lake is closely interdependent, any factor that adversely affects the bream will create poor fishing.

"It was explained that bream gain most of their weight during the spring and fall. There is very little growth in the summer. Last spring the muddy water tied up the phosphate in the fertilizer and shut out the light that is necessary for the growth of microscopic plants. Without an abundance of microscopic plants there is little biologic life upon which the bream feed. The bream did not grow and did not spawn in their usual abundance. Because of the scarcity of young bream, the bass did not eat well. So, all in all, a very unhappy situation existed.

"This experience again illustrates the real need for consideration of the hydrologic and erosion-control aspects of farm fish pond design and management. For best results in fertilized ponds the supporting watershed should border on being too small, unless excess runoff can be diverted. This accentuates the need for a better knowledge of the runoff-producing qualities of watersheds and the pond losses to seepage and evaporation."

Microbiological Studies - F. L. Duley, Lincoln, Nebraska.-"In our work in cooperation with the Hastings Project, we have seeded more sweet clover, both annual and biennial. We also have seeded lespedeza and partridge peas. Sweet clover residue is being used for corn, sorghum, oats, and wheat. Also bromegrass and crested wheat grass were seeded in this residue last fall. Excellent stands and early spring growth have been obtained.

"In our microbiological work, counts have been made to get additional information on the effect of residues on numbers of fungi and total count (bacteria plus actinomyces). The results indicate that the count goes up wherever the organic matter is undergoing decay. On subtilled land the greatest numbers of organisms is in the surface inch. Where the residue has been turned under the higher count is in the 1-6 inch layer. A sample of the results is shown in the following table:

Microbial Populations from Rotation Plots March 28, 1946

Depth	No residues plowed	Residues plowed	Residues subtilled	Mean
Inches		Fungi $X10^4$		
0-1	29.1	31.7	58.3	39.70
1-6	55.7	52.4	43.2	50.43
Mean	42.4	42.05	50.75	45.07
		Total count $X10^6$		
0-1	25.9	32.3	57.2	38.47
1-6	43.0	52.0	55.8	50.27
Mean	34.45	42.15	56.5	44.37

"Tests for nitrates have shown that the nitrate content of the soil is low this spring. This has already caused noticeable effect on the growth and vigor of wheat in many fields."

Soil Physics Studies - F. A. Kummer, Auburn, Alabama.-"The tilth studies on the Tennessee Valley Experiment Station plots were continued, and the following data were summarized on the basis of three samplings, December 12, February 22, and March 29. (Decatur clay loam)

Previous crop	% Non-capillary pore space, surface soil at 60 cm. tension		
	December 12	February 22	March 29
Continuous corn	22.8	31.1*	28.8
Cont. corn + N	25.1	30.6*	29.0
Cotton, vetch planted in fall***	30.5	19.8	13.0**
Oats, soy hay, vetch planted in fall***	23.8	19.4	15.7**

* plowed March 6
** plowed April 7
*** In 3-year rotation with legumes

"As sampling progresses, it appears to become more evident that the corn plots retain a much higher porosity than the other plots. Indications are that this is possibly due to the nature and action of the corn roots. At a recent meeting with Soil Conservation Service and Station personnel at Mississippi State College, it was agreed to initiate a cooperative project to study the effect of plant roots on soil porosity. Dr. Leonard and Messrs. Woodburn and Jones agreed to conduct studies of this nature on the Mississippi Station cropping systems plots."

Hydraulic Studies - F. M. Blaisdell, Minneapolis, Minnesota.-"Mr. Donnelly largely completed his check tests on rectangular spillway outlets. These tests were run using box inlets having lengths varying from one-half to two times the width and depths of box varying from one-fourth to one times the width. The length of the uniform width transition located between the box inlet and the stilling basin proper was varied from the minimum length determined from the studies to an extremely long length to discover the effect of these changes on stilling basin performance. No effect was apparent. Long transitions may occur where the transition is, for example, a highway culvert joining the box inlet and stilling basin. The length of the stilling basin was varied from minimum to an extreme length and the sidewall flare was varied from two longitudinal to one transverse (the maximum permissible) to straight. The results in all the check tests were as expected. All of the tests have been run on half-models. A few tests were run on full models half the size of the half-models and for one test of the full model a duplicate

test was run in which a lucite plate was located at the model center line to produce two half-models. The results obtained with the half-size full model were identical, within the limits of experimental precision, with those obtained on the half-model.

"During the month of April the installation of the 1-1/8-inch pipe drop inlet model was completed. Twenty-one test runs were made and the data were recorded both by the pressure recorders and by photographic means as described in our March report. The data was analyzed and plotted using the dimensionless parameters $Q/D^{5/2}$ and H/D where Q is the discharge in cubic feet per second, D is the pipe diameter in feet, and H is the head on the box drop inlet in feet. The head-discharge relation for the 1-1/8-inch and the 4-1/2-inch models, when plotted in the above manner, shows a very close agreement of the experimental data over the range covered by the tests. Also the pressures at a point one-half a pipe diameter below the junction of the riser and the pipe appear to be in close agreement, although at the end of the month the analysis of the data was not complete. Comparisons of pressures at other points within the model will also be made.

"Mr. Blaisdell continued his analysis of the data obtained from the transition experiments as time permitted. One very important benefit derived through the use of transitions was brought out by a comparison of the amount of concrete and the volume of excavation saved in the SAF stilling basin when a transition is used. It was realized before the study began that some savings would be possible but the magnitude of the saving was greatly under estimated. Savings up to 63 percent in the amount of concrete in the stilling basin walls and floor and up to 31 percent in the amount of excavation were computed for one case. Monetary savings should be greater than this, however, because the depth of excavation is decreased and this is the most difficult and expensive part of the excavation. Much expensive sidewall concrete is saved through the use of transitions at the cost of some increase in the less expensive floor concrete, the net result being a considerable reduction in the total amount of concrete required. In making these comparisons it was assumed that the increased quantity of concrete in the transition floor would be compensated by the decreased quantity required in the transition sidewalls due to the decreased depth of flow in the transition. A report presenting the results of this study to date is planned but no work has yet been done on it."

Hydraulic Studies - V. J. Palmer, Stillwater, Oklahoma.-"In conjunction with the Region 4 engineering staff, a handbook of vegetal channel design is being prepared in this office. William P. Law Jr., formerly on the Research staff, was detailed by Operations to assist in its preparation.

"The important results of several years of channel testing at this laboratory were included in the recently completed 1945 annual report. These are some of the significant observations:

1. The experimental results substantiate the argument previously developed by this project for using $\overline{VR}$ (product of velocity and hydaulic radius) for judging the value of $\underline{n}$ (the retardance coefficient). The effect of slope is without question accounted for in this criterion. That $\underline{R}$ adequately represents the effect of shape is not as positive. Since the greatest percentage of the flow is down the center portion of a field channel, with areas of almost 'dead water' on the edges, the hydraulic radius, which is approximately the average depth, is too low. The correct depth value lies between $\underline{R}$ and the center depth and varies with cross-sectional shape. Fortunately, the error in using the hydraulic radius is not serious. Its use tends to result in a conservative design.

2. Grass length has a higher influence on Manning's $\underline{n}$ than ordinarily considered. Mowing or grazing (if controlled) is very desirable if capacity is important.

3. Density of Bermuda grass cover appears to have little effect on Manning's $\underline{n}$. The study included covers ranging from fair to very good.

4. Second year covers of unmowed covers of Bermuda grass and weeping lovegrass afforded considerable increased retardance the second year.

5. A long, green excellent cover of ischaemum (yellow bluestem) gave the same degree of retardance as second year unmowed weeping lovegrass. These two covers have produced the highest retardance to flow of any covers yet tested in the laboratory. The $\underline{n}$-$\overline{VR}$ relationship is significantly higher than that for lespedeza sericea.

6. For good covers established on silt loam the velocities selected as permissible are 8 feet per second for Bermuda grass and 3.5 feet per second for weeping lovegrass and ischaemum. The use of the latter two bunch grass covers on slopes steeper than 5 percent is not recommended.

"Stability-duration studies on long Bermuda grass were described in a previous monthly report. Even after 13 hours at $\overline{V}$= 8 feet per second and 5 hours at $\overline{V}$= 13 feet per second a good uniform cover on a 5 percent slope remained essentially intact. Less than 1/4 inch of soil was lost. In a similar experiment a channel lined with short dormant Bermuda grass lost less than three-fourths inch of soil. Although the bed was somewhat pitted and many small roots were exposed the channel remained in a condition capable of healing. The importance of completeness and uniformity of cover in endurance tests of this type cannot be over-emphasized."

Hydraulic Studies - A. W. Marsh, Corvallis, Oregon.-"Several irrigated alfalfa fields in the Southern Wasco Soil Conservation District were examined for the purpose of setting up evaluation studies to compare the Service recommended irrigation practices with the previously prevailing methods as to quantity of water used, labor required to irrigate, and yields.

"At the Malheur Station work was commenced on plots comprising the irrigation trials on non-saline soil. The land was prepared, dikes constructed between plots, and fertilizers and amendments applied as well as the subsoiling. After the treatments were disked in and the land harrowed, barley was seeded on the grain plots. At this time insufficient surface moisture remained to permit seeding the grass plots so corrugations were made and a light irrigation is being applied to the grass plots. Since ditches and weirs would interfere with seeding the grass plots, this preirrigation is being applied with Ames furrow-type irrigation pipe."

Hydraulic Studies - Stephen J. Mech, Prosser, Washington.-"Irrigation water was available to the farms below the main canal on about the first of April. The Irrigation Branch Experiment Station being under the pump, did not receive water until about the middle of the month. This delay plus erratic delivery has delayed and aggravated the irrigations on the Station.

"Twelve alfalfa plots whose minimum available moisture limit is 60 percent, were irrigated April 23-26. Rough calculation of infiltration for these plots show the character of alfalfa's influence on infiltration. Two-year old alfalfa had an average infiltration rate of 0.66 inch per hour when irrigated in a furrow grade of 2 percent and 0.27 inch per hour when the furrow grade was 7 percent. The alfalfa seeded in September 1945, now about a foot high, averaged only 0.26 inch per hour and 0.10 inch per hour for the 2 percent and 7 percent furrow grades, respectively.

"The infiltration rate on the new seeding showed no increase over that from corn and potatoes in 1944 and 1945. It seems that though the plot surface was well covered with vegetation, the furrows themselves were not materially different from that during the row crops years.

"Soil losses for both the new and old seedings were definitely large enough to be measured. They will be reported as soon as laboratory work on runoff samples can be completed.

"Manufacture of Bouyoucos blocks is being continued. Ninety blocks were installed in the furrow and ridge at depths of 1, 2, 3, 4, and 6 feet. It is hoped that additional blocks can be installed so that with the help of the gravimetric plugs the laborious soil sampling before irrigation will be reduced and perhaps ultimately eliminated."

Hydraulic Studies - Vito A. Vanoni, California Institute of Technology, Pasadena, California.-"The first draft of a preliminary report on the model test of the Rock Eagle Lake Spillway was completed. A 1:50 scale model of Lake Coffee Mill Spillway Plan V was installed in the basin and a series of tests was completed using a flat floor on the structure. Tests indicated that there was some asymmetry in the inflow to the spillway. This spillway has a crest that is circular in plan view and the width of the structure reduces gradually between the crest and the stilling basin. The tests showed that the converging walls caused the flow to concentrate near the center of the structure at the inlet to the stilling basin. This resulted only in partial stilling action in the hydraulic-jump stilling basin. The next step in the tests is to crown the floor in an attempt to distribute the water uniformly across the structure at the entrance to the stilling basin."

Sedimentation Studies - Carl B. Brown, Washington, D. C.-"Good progress was made in the investigation of reservoir silting in the Central Valley area, Calif. Most of the field work of reservoir surveys has been completed. Data on several reservoirs were computed and checked during the month. The original data on the surveys of Pardee Reservoir, made by the East Bay Municipal Utilities District were obtained and recomputed. Extensive data collected by the California Debris Commission on Lake Combie were analyzed, and a study of similar data on Bullardo Bar Reservoir is underway. Reconnaissance conservation-survey mapping of the watershed areas was pushed ahead up to the snow line, which was about 7,000 feet elevation in the southern part of the Sierras and about 6,800 near Donner Summit at the end of the month. About 2,300 square miles had been mapped as of April 15.

"The Federal Inter-Agency River Basin Committee, created by executive order to coordinate planning for water control and utilization on drainage areas and composed of representatives of the Departments of War, Interior, and Agriculture and the Federal Power Commission voted at its meeting in April to establish a subcommittee on sedimentation to correlate the activities of the various Federal departments in this field of investigation. This committee will supercede and take over the work of the committee on study of sediment loads of streams which has been in existence for 6 years. Its scope will be sufficiently broad to cover the entire field of sediment investigations and control methods."

Sediment Studies - Vito A. Vanoni, Cooperative Laboratory, California Institute of Technology, Pasadena, California.-"A manuscript by Hugh Stevens Bell entitled, 'Thermal Density Currents in Shaver Lake' was completed. This manuscript is intended for publication in the Transactions of the American Geophysical Union.

"On April 3 to 5 a group from the Laboratory visited the Cebada Canyon Watershed near Lompoc, California, to study the flood control and sedimentation problems of that area. The Soil Conservation Service is preparing preliminary plans for the flood control in this area and the Laboratory was requested to give assistance in this work.

"Several small valleys with watersheds 10 square miles in area or less have developed gullies in the valley bottoms during the last 50 years. In their original state there was no well-defined drainage in any of these canyons. The flow from these canyons, which is heavily laden with sediment, discharges into the valuable valley land and deposits considerable material which damages both the land and the crops. The problem is to protect these lands as well as the valley bottoms of the tributaries themselves. The protection work involves the stabilization of existing gullies and the prevention of the formation of new ones. This control work can be done by normal methods, but the expense of such work would be greater than appears justifiable. Therefore, in order to do this work at a reasonable cost, it will be necessary to develop cheaper means of effecting the controls."

Drainage Studies - Ellis G. Diseker, Raleigh, North Carolina.- "The Research drainage installation on Bladen silt loam at the J. V. Taylor farm, near Bethel, N. C., was begun in February and was completed May 4, with the exception of the installation of water wells and the hand sloping of 4,079 feet of small open ditches which were cut with a tile-trenching machine. Also, the spoil banks on some of these ditches are to be spread. The sloping of these ditches will be accomplished as quickly as labor is available.

The following construction for the drainage experiments was completed:

1. An outlet ditch 3 to 5-1/2 feet deep, emptying into an old drag-line canal which also was deepened and cleaned out.
2. 6,000 feet of old ditches were filled.
3. 3 V-ditches each 785 feet in length.
4. 2 double bed drains, each 595 feet in length, spaced 90 to 120 feet apart. These are essentially a terrace with a 20 foot base, 18 to 24 inches high, with a channel on each side 10 to 18 inches deep, with a bottom width of 18 to 24 inches, and a top width of 10 to 12 feet.
5. 3 single bed drains (small V-ditches) of 595 feet in length, having 1 foot bottom width, 12 to 16 inches deep and 9 to 11 foot top width, and drain spaced 60, 90, and 120 feet apart.
6. 4 small ditches, each 740 feet in length, averaging 3 feet in depth, 18 to 24-inch bottom width, 7.5 to 8.0 foot top width, and ditches spaced 60, 90, and 120 feet apart.

7. An interception ditch 1,848 feet long with depth of 2-1/2 feet at the upper end, and 5 feet deep at the lower end. This ditch, laid out in the form of an "L", will intercept water from several acres of high ground, also runoff from a considerable wooded area, and empties into the lead ditch at the south end of the experimental area.

8. 9 small ditches, each averaging 452 feet in length, 3 feet in depth and 19 inches wide with a grade of 0.2 foot per 100 feet and 1-1/2:1 side slope, and ditches spaced 50, 100, 150, and 200 feet apart.

9. 5 lines of tile, each line 700 feet in length at average depth of 2 feet.

10. 4 lines of tile, at average depth of 3 feet, the first three being 700 feet long, and the last line 673 feet long. The last 73 feet of the upper end of the last line is completely wrapped with 2-ply roofing paper, also the upper 500 feet of one line is completely wrapped with strips of roofing paper 6 inches wide and 18 inches long.

11. 4 lines of tile at a depth of 4 feet, each line being 673 feet long. One line has the upper end of the joints completely wrapped for a distance of 473 feet. The upper 73 feet of the other lines are also completely wrapped. Also tile lines which do not have the joints completely wrapped as noted above, have a strip of 2-ply roofing paper, 6 inches wide and 9 inches long, semi-circling the upper portion of the joints to prevent silting. With a comparison of the partially and completely wrapped joints it will be possible to determine if it is necessary to wrap tile joints in this type of soil.

"All tile lines have a grade of 0.2 foot per 100 feet and all tile is of 4 inch diameter and the lines are spaced 50, 75, and 100 feet apart for each depth with a guard step and extra line between the different depths. The guard line is installed at the shallowest depth, spaced 50, 75, and 100 feet apart. The bed drains and V-ditches have an outlet at each end. The water is conducted through an 8 inch terra cotta pipe into the outlet ditches to prevent overfall and head-water erosion. Open ditches which have an overfall of 6 inches or more into the main outlet also have an 8 inch pipe installed in the end of the ditch to prevent erosion."

Drainage Studies - R. E. Morris, North Liberty, Indiana.-"Total rainfall for the month was 1.48 inches which is approximately one-half normal.

"About 0.5 mile of 5-inch drain tile were placed in the drainage plots. An eight-man crew was assembled for the work and we were able to do the ditching, laying, and blinding-in within 5 days. Onions and carrots were sown in the plots immediately following the tiling operations.

"Because of the comparatively dry weather the muck soil in this area became quite susceptible to blowing and serious damage was done to onion crops by high winds on April 25 and 26. Soil drifts 12 inches in height were in

evidence at the experiment farm and in fields belonging to commercial growers. Permanent windbreaks were largely ineffective in this particular case because they are located to give protection from westerly winds and the damaging winds came from the north. This is an erosion problem in this area which deserves attention."

Drainage Studies - I. L. Saveson, Baton Rouge, Louisiana.-"During the winter months we roughly designed and have fabricated most of the parts for a sled-type experimental mole machine. We worked this up more for an experimental machine rather than a field machine in order to determine some of the factors involved in constructing mole channels. We hope that after we have completed our experiments, with a few minor changes or additions, we can adapt it for field operations. The machine has the following facilities and we hope to determine with it:

1. The tow beam is mounted by a parallelogram to a set of sled runners, trying to devise a means of having the line of draft cut across the mole point for various depths, thus by being mounted on a parallelogram, as the mole point goes deeper the distance from the tractor becomes greater.

2. Length of tow beam can be varied in order to determine length of beam necessary to make the line of draft follow in the right location and have the machine penetrate and run even.

3. The blade or beam to which the mole point is fastened is constructed hollow from two 3/8-inch plates welded together and the mole point is also hollow. This will be perforated with very small drill openings and hooked to water pressure in order to lubricate the point and blade, thus trying to reduce the amount of draft of the mole machine. This machine is to be equipped with a telescoping hitch and latch. When the latch is released the tractor will pull the point out of the ground.

4. Provisions for installing moles on grade. It is contemplated hooking a hydraulic jack in the linkage between the hitch and tow beam in order to vary the depth while the machine is operating.

"Last fall we started operations on the Smithfield Plantation, working out a block of 12 cuts. One cut was completely crowned and graded and another partially when we had to stop operations on account of wet weather. We started operating this spring to finish this work and we should complete it the week of April 15. The record of work done is as follows:

Cut 1. Graded with bulldozer and Caterpillar.

2. Grading work started with Caterpillar 50 and grader. We were forced to finish it with bulldozer due to bad weather.

3. Shoulders were first cut down and flattened with Caterpillar 50 and grader. Cut was crowned with bulldozer and smoothed up with Caterpillar 50 and grader.

4. This cut was crowned by plowing, using W-9 International wheel tractor and a 4-bottom John Deere disk plow. The cut was plowed 7 times. The shoulders were later cut off with Caterpillar 50 and grader.

5. This cut was graded entirely with Caterpillar 50 and grader.

6. This cut was entirely crowned by grading with bulldozer on a Model SO tractor without cutting shoulder off or flattening, as was done on Cut 3. The Caterpillar 50 and grader were used to smooth the cut after grading.

7. This cut was crowned with W-9 wheel tractor and Parson Whirlwind terracer. The cut was worked 4 times and the shoulders cut off with Caterpillar 50 and grader.

8. Shoulders only removed with Caterpillar 50 and grader and earth worked back from lateral ditches just far enough to waste it.

9. Shoulders removed with bulldozer on SO tractor. Earth worked back from lateral ditches just far enough to waste it.

10. This cut was left as a check.

11 & 12. These cuts are small cuts and are not used for cane production.

"Along the west side of this block of cuts was a quantity of spoil on the ditch bank. It was light spoil running about 100 cubic yards to the station. This spoil was thrown back from the ditch with the D-4 Caterpillar tractor equipped with dragline attachment and smoothed up with bulldozer. On the east side of this block of cuts, 8, 9, 10, 11, and 12, was some heavy spoil which we could get back of with the bulldozer. This spoil runs about 300 cubic yards to the station."

Drainage Studies - Lee D. Dumm, Athens, Georgia.-"On April 4 the rough draft of the Climatological Report with regard to drouth frequencies in the different agricultural areas of Georgia was completed and given to Mr. Driftmier, Head of Agricultural Engineering Department, University of Georgia, for corrections and criticism."

Drainage Studies - C. Kay Davis, The Everglades Project, Fort Lauderdale, Florida.-"The Lake level on May 1, was 15.46 (Okeechobee Datum). This is about 0.9 of a foot drop during the month of April. Practically all of this discharge was made through the St. Lucie and Caloosahatchee canals.

"Ten (10) Acres were diked on Section 9 of the Wallis Farm and Mr. Wallis is of the opinion that the studies to be made on relation of soil type and depth and underlying material to pumping requirements should be made

on the 10 acres in Section 9 during the month of June since the water level is higher at that time of the year. We had originally planned to leave the pump at its present location until the water level was about a foot above the ground surface outside the dike area and run another test at that time. I would like to run the test on the Brown Farm when the water level is at its maximum and this may necessitate moving the pump to Section 9 and then moving it back to its present location. We will watch conditions and be guided accordingly so that a test can be made at both places this summer."

Drainage Studies - M. H. Gallatin, Homestead, Florida.-"Since the last of March, little or no rain has fallen in this area. As a result, our water tables have dropped very fast during the month. The Well E-33 at the first of the month had a ground-water table 1.23 feet above m.s.l. The reading on April 30, shows the water table was a minus 0.19 foot below m.s.l. This was the only minus elevation recorded for the area though many of the wells are very close to m.s.l. at the present time. The greatest drop again occurred in the marl area.

"If no rain falls during the next few days the water table will drop below m.s.l. over most of the lower part of the area."

IRRIGATION DIVISION

Evaporation, Transpiration and Seepage Losses Affecting Irrigation Practices - Salinas Valley, Calif.-Harry F. Blaney reports that the chapter on Consumptive Use of Water in Salinas Valley, prepared for the report of the California Division of Water Resources, was completed. It includes detailed climatological and evapo-transpiration data for the Pressure, East Side, Forebay, Arroyo Seco, and Upper Valley areas. In connection with the overdraft investigation of ground-water supply in the lower portion of the valley, the State Engineer requested an estimate of monthly evapo-transpiration losses in areas of high water table. Unit values of monthly consumptive use of water for several crops were calculated as follows:

Month	Evapo-transpiration (irrigation season)			
	Alfalfa	Medium brush-trees 1/	Dense trees-brush 1/	Swamp 1/
	Inches	Inches	Inches	Inches
April	2.96	2.92	5.47	4.39
May	4.04	3.38	7.15	6.58
June	4.79	3.52	7.61	6.95
July	4.96	3.65	9.24	7.81
August	4.67	3.42	8.64	6.77
September	4.15	3.05	7.52	6.02
October	3.23	2.71	3.37	4.67
Totals	28.80	22.65	49.00	43.19

1/ Growing in area of high water table, with ample ground water to take care of evaporation and transpiration.

Santa Ana River, Calif.-After establishing the altitude of the reference points on several observation wells in Santa Ana Canyon, Dean C. Muckel tabulated the well records and drew various cross sections and profiles of the ground-water table. It is apparent from these records that the stream is influent during the summer months and supplies at least part of the water being used by the valley vegetation.

Evaporation from Water Surfaces.-A. A. Young reports further compilation of evaporation records for California is progressing steadily. The compilation will eventually include all the evaporation data in the State, together with appurtenant temperature and wind records where such data are available. The results will eventually become available for distribution by publication in a State of California bulletin. Evaporation records are available from all parts of the State but are more numerous in the southern part where the water supply is least and storage reservoirs are more numerous.

Depths of annual evaporation vary greatly according to differences in local conditions, as much as 75 to 100 inches difference being observed between evaporation from a Weather Bureau pan in the Colorado Desert and similar pan in the mountains. As much as 100 percent difference in a single month has been noted at two stations 10 miles apart, one being affected by dry desert winds while the other was not. This is the first attempt to correlate all evaporation data in the State, and the result is expected to be useful in many ways, particularly in connection with estimating evaporation losses from surfaces of water stored in reservoirs for irrigation and as indices of plant irrigation requirements on soil-conservation districts and other irrigated areas.

Studies of Irrigation Practices as They Affect Water Supplies.- Dean W. Bloodgood reviewed a memorandum prepared by Penn Livingston of the Geological Survey, regarding the drilling of wells by Ward County Irrigation District No. 1 near Barstow, Tex. Since November 7, wells have been drilled about 1/4 mile apart along the bank of the Main Canal, and the district plans to drill four more to supplement the water supply from Red Bluff dam. The water is pumped direct into the Main canal. Red Bluff Reservoir has about 61,000 acre feet of water--probably only enough for one irrigation.

Mr. Bloodgood obtained analyses of the waters of four of the wells. Water from Well No. 4 contained 204 ppm. bicarbonate, 2,310 ppm. sulfate, and 2,010 ppm. chloride. Water from well No. 5 contained 182 ppm. bicarbonate, 2,410 ppm. of sulfate, and 1,660 ppm. chloride. Water from Well No. 6 contained 180 ppm. bicarbonate, 2,190 ppm. sulfate, and 1,680 ppm. chloride. The Buckelew well and lowest one along the Main canal showed 226 ppm. bicarbonate, 2,420 ppm. sulfate, and 2,240 ppm. chloride. Mr. Bloodgood notes that "these waters are considered good for irrigation in the Pecos Valley, the only place in United States I know of where no one knows anything about the quality of water as it affects plant growth."

Snow Surveys and Irrigation Water Supply Forecasts - April forecast summaries.-R. A. Work and Paul A. Ewing assembled the reports of the April snow surveys throughout the Western States and prepared news releases and articles for two magazines summarizing the results. The overall 1946 outlook is for runoff generally equaling or exceeding the long-term average in the northern half of the Mountain and Pacific States, but for subnormal supplies in the southern drainage basins. In portions of the Columbia River Basin, runoff may be as much as 200 percent of normal, a potential flood menace being indicated along both sides of the Cascade Mountains and the lower reaches of Kootenai River. The decline from north to south is progressively emphatic, however, and New Mexico, southern Utah, Arizona, and southern California will experience shortages of severe proportions. The deficiencies will be somewhat eased by carry-over storage, which, with careful use, may be enough to meet 1946 requirements of most areas having storage rights.

Detection of measurement errors.-R. A. Work reports the investigation of an error in measurements on a Mt. Hood snow course which disclosed precautions necessary where snow characteristics are peculiar. On the course in question the April 1 survey showed only 50 inches of snow, which was somewhat below expectation. A resurvey showed about 85 inches. The discrepancy was found to be due to the "corky" character of the snow. This caused the snow to stick in the tube and prevented entrance of a full core as the tube was thrust to the ground. The best method in such circumstances is to take each sample in sections, as was demonstrated to the survey crew.

Storage of Water Underground for Irrigation - San Joaquin Valley, Calif.-Dean C. Muckel reports that in view of the results obtained in the laboratory on soil cores and verified on some of the field test ponds it seems rather definite that micro-organisms are at least one of the causes for the decrease in percolation and also that they tend to aggregate the soil upon drying. It is planned to operate some of the field test ponds so as to determine how the microbial action in soil aggregation can best be utilized under field conditions.

Antelope Valley, Calif.-Dean C. Muckel visited an area being developed for spreading of waste water from the Los Angeles Owens River aqueduct. The spreading system is on Kings Canyon debris cone and when completed will consist of 20 basins formed by contour dikes. The water supply to each basin is controlled by gates and each basin can operate independently of the others. The completed system will have a total wetted area of 80 acres. A 42-inch outlet was installed in the aqueduct by the City of Los Angeles and local people are doing the remaining part of the work. Percolation tests made last year at this location showed initial percolation rates of 12 feet per day with a steady decrease to about 1 foot per day over a period of many weeks. According to our experiments elsewhere the initial rates can be expected to recover with a thorough drying of the soil.

Drainage of Irrigated Lands - Imperial Valley, Calif.-V. S. Aronovici reports that two irrigation studies were completed on 1/4 mile runs, and results of all irrigation runs involving the soil-moisture gain as related to irrigation application, water-table rise, and salt balance were summarized. The studies conducted on areas having water table at 4 feet or less, were much less satisfactory than runs conducted on fields where the water table was considerably deeper. No direct relationship appeared between the period water stood at any given station and the total quantity of water entering the soil. Rate of intake per hour was slower for stations having long ponding time than at stations having short ponding period.

In an effort to evaluate this phenomenon further a small infiltrometer was designed. The unit consists of two metal rings 7 and 10 inches in diameter, held together with metal spokes. A mariotte bottle supplies

water to the outer ring. The water supplied to the inner cylinder is provided by a mariotte apparatus; however, a cylinder 4 feet long is used instead of a bottle. This cylinder is graduated in 100 cc. units so that a close check of the rate at which water is supplied to the cylinder can be obtained. As an added check a hook gage is used to observe minor fluctuations in water level within the inner ring.

Three runs were completed. The first run was made on silty clay loam soil with a high water table and considerable soil moisture present in the upper soil profile. The second run was conducted on silt loam to silty clay loam soil, with low moisture content in the upper profile and with a water table below 6 feet. The third run was made on light fine sandy loam soil with a water table at 4 feet and a rather high soil-moisture content below 4 inches.

Although the soil textures of run I and run III are quite different, the water table is high in both cases and the final rates of intake are very similar. Run II showed the highest rate. These preliminary runs suggest the complexity of the problem of setting up criteria for irrigation layouts and show the need for continued investigation along these lines.

Water Requirements of Cowlitz District, Ore.-E. C. Gwillim reports that estimates of irrigation-water requirements were made for the Cowlitz Soil Conservation District. Little irrigation has been developed in the district, so it was necessary to compare it with areas of similar climate, soils, and crops. It was concluded that 18 to 24 inches of irrigation water would be required.

Opportunity for Drainage Studies.-J. S. James reports that work underway by Operations in the Big Horn Soil Conservation District will provide a full-scale laboratory for drainage studies. It will cover an area of some 10,000 acres, embracing the upper part of the irrigated section near Hardin, Mont.

The area appears to present many of the factors typical of the drainage of irrigated land. These include the sources of excessive water - canal seepage, excessive application of irrigation water, restricted surface drainage, etc.; the movement of ground water through the complex formations of the river valley; and the hydraulic properties of various soils and subsoils.

More than 100 observation wells are now being established by the Work Unit in cooperation with the Big Horn Soil Conservation District. Holes are put down with an earth-boring machine operated by the Service. This machine is equipped to bore an 8 inch hole to a maximum depth of 30 feet. The wells are cased with 3 inch galvanized iron downspouting. Water observations will be made at monthly intervals.

Some of the clay soils of the area are as much as 20 feet deep. An interesting feature of the investigation will be explorations through these deep clays and observations of the hydrostatic water level. These explorations may indicate the desirability of wells in drainage ditches to reduce the water pressure under these tight soils.

A similar investigation is contemplated in the Paradise Soil Conservation District in the Milk River Valley. This District has areas of deep clay soils similar to some of those in the Big Horn District. In other ways, however, the areas are quite different and other phases of the drainage problem will be presented.

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